SFUND RECORDS CTR
2394054

SITE NARRATIVE

SITE NAME: **Palos Verdes Shelf Sediment Contamination**

EPA ID NO.: **CAD008242711**

Sediments on the seafloor southwest of the Palos Verdes Peninsula in Southern California contain the chlorinated pesticide dichlorodiphenyltrichloroethane (DDT) and its metabolites and polychlorinated biphenyls (PCBs) from years of effluent discharge from the White's Point outfalls of the Los Angeles County Sanitation Districts. Releases of hazardous substances peaked in the early 1970s, after which source controls and treatment technologies reduced the rates of discharge of DDT, PCBs, and settleable solids. Less-contaminated effluent and natural sedimentation has buried some of the contamination. Existing surface contamination and physical, chemical, and biological processes that bring contaminants to the sediment surface result in the release of hazardous substances to the environment where uptake by benthic organisms and fish carries the contaminants higher up the food chain.

The Palos Verdes Shelf extends seaward along a 12-kilometer stretch of coastline that ranges in width from 4 kilometers near Point Fermin on the east to 1.5 kilometer near Point Vincente on the west. The volume of effluent-affected sediments on the shelf is approximately 8.2 million cubic meters. It covers an area of approximately 13.5 square miles. The contaminated sediments are covered by 30 to 500 meters of water.

The Palos Verdes Shelf supports several commercial and sport fisheries. White croaker (*Genyonemus lineatus*), bottom-feeding fish that reside on the Palos Verdes Shelf, contain levels of DDT and PCBs that have resulted in the California Environmental Protection Agency's Office of Health Hazard Assessment issuing health advisories against the consumption of white croaker caught from White's Points or anywhere along the Palos Verdes Shelf. The commercial white croaker fishery is also closed in this area.

Humpback whales (*Megaptera novaenagliae*) have been observed migrating through the San Pedro Channel. Brown pelican (*Pelecanus Occidentalis*), bald eagle (*Haliaeetus leucocephalus*), and peregrine falcon (*Falco peregrinus*), federally listed endangered species, inhabit the Santa Barbara Channel Islands and forage throughout the Southern California Bight.

All species have low breeding success in this area which has been attributed to high concentrations of DDT in the birds and their eggs. Biomagnification of DDT via gulls, other sea birds, and marine mammals is the main cause of high DDT residues still observed in bald eagles and peregrine falcons. While studies of the problem do not contend that all of the contamination observed in the birds that live in the Southern California Bight area comes from biomagnification of the contamination in the effluent-affected sediments on the Palos Verdes Shelf, they do feel that this is an important source.

There are no freshwater aquifers beneath the contaminated sediments. The water column above the sediments restricts the potential for direct contact or the release of contaminants to the air.

HAZARD RANKING SYSTEM
SUMMARY SCORESHEETS

SITE NAME: Palos Verdes Shelf Sediment Contamination

CITY/COUNTY/STATE: Los Angeles County, California

EPA ID #: CAD008242711

EVALUATOR: Karen Johnson **DATE:** June 25, 1997

LATITUDE: 33° 42' 38" N. **LONGITUDE:** 118° 22' 32" W.

	S	S^2
Groundwater Migration Pathway Score (S_{gw})	NQ	NQ
Surface Water Migration Pathway Score (S_{sw})	100.00	10,000.00
Soil Exposure Pathway Score (S_s)	NQ	NQ
Air Migration Pathway Score (S_a)	NQ	NQ
$S_{gw}^2 + S_{sw}^2 + S_s^2 + S_a^2$	XXXXXXXX	10,000.00
$(S_{gw}^2 + S_{sw}^2 + S_s^2 + S_a^2) / 4$	XXXXXXXX	2,500.00
$\sqrt{(S_{gw}^2+S_{sw}^2+S_s^2+S_a^2)/4}$	XXXXXXXX	50.00

NQ = Not quantified

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET

Factor Categories and Factors

DRINKING WATER THREAT

		Maximum Value	Assigned Value
	Likelihood of Release		
1.	Observed Release	550	550
2.	Potential to Release by Overland Flow		
	2a. Containment	10	
	2b. Runoff	25	
	2c. Distance to Surface Water	25	
	2d. Potential to Release by Overlands Flow [lines 2a x (2b+2c)]	500	
3.	Potential to Release by Flood		
	3a. Containment (Flood)	10	
	3b. Flood Frequency	50	
	3c. Potential to Release by Flood (lines 3a x 3b)	500	
4.	Potential to Release (Lines 2d+3c, subject to a maximum 1 of 500)	500	
5.	Likelihood of Release (Higher of lines 1 or 4)	550	550
	Waste Characteristics		
6.	Toxicity/Persistence	a	
7.	Hazardous Waste Quantity	a	
8.	Waste Characteristics (lines 6 x 7, then assign a value from Table 2-7)	100	NQ
	Targets		
9.	Nearest Intake	50	
10.	Population		
	10a. Level I Concentrations	b	
	10b. Level II Concentrations	b	
	10c. Potential Contamination	b	
	10d. Population (lines 10a + 10b +10c)	b	
11.	Resources	5	
12.	Targets (lines 9+10d+11)	b	0
13.	Drinking Water Threat [(Lines 5 x 8 x 12)/82,500, subject to a maximum of 100]	100	0

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET

	Factor Categories and Factors	Maximum Value	Assigned Value
	HUMAN FOOD CHAIN THREAT		
14.	Likelihood of Release (Same value as line 5)	550	550
	Waste Characteristics		
15.	Toxicity/Persistence/Bioaccumulation	a	5×10^8
16.	Hazardous Wste Quantity	a	1×10^6
17.	Waste Characteristics (Toxicity/Persistence x Hazardous Waste Quantity x Bioaccumulation,. then assign a value from Table 2-7)	1,000	1,000
	Targets		
18.	Food Chain Individual	50	45
19.	Population		
	19a. Level I Concentrations	b	0
	19b. Level II Concentrations	b	0.03
	19c. Potential Human Food Chain Contamination	b	0
20.	Targets (lines 18 + 19d)	b	45.03
	Human Food Chain Threat Score		
21.	Human Food Chain Threat [(Lines 14 x 17 20)/82,500 subject to a maximum of 100]	100	100.00

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET

		Maximum Value	Assigned Value
	Factor Categories and Factors		
	ENVIRONMENTAL THREAT		
	Likelihood of Release		
22.	Likelihood of Release (Same value of line 5)	550	550
	Waste Characteristics		
23.	Ecosystem Toxicity/Persistence Bioaccumulation	a	5×10^8
24.	Hazardous Waste Quantity	a	1×10^6
25.	Waste Characteristics (Ecosystem Tox./Persistence x Hazardous Waste quantity x Bioaccumulation, then assign a value from Table 2-7)	1,000	1,000
	Targets		
26.	Sensitive Environments		
	26a. Level I Concentrations	b	0
	26b. Level II Concentrations	b	300
	26c. Potential Contamination	b	0
	26d. Sensitive Environments (lines 26a + 26b + 26c)	b	300
27.	Targets (Value from line 26d)	b	300
	Environmental Threat Score		
28.	Environmental Threat Score [(lines 22 x 25 x 27)/82,500 subject to a maximum of 60]	60	60.00
	SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORE FOR A WATERSHED		
29.	Watershed Score [(Lines 13 + 21+ 28), subject to a maximum of 100]	100	100.00 c
	SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORE		
30.	Component Score (Sof) (Highest score from Line 29 for all watersheds evaluated, subject to a maximum of 100)	100	100.00 c

a Maximum value applies to waste characteristics category.
b Maximum value not applicable.
c Do not round to the nearest integer.

HRS DOCUMENTATION RECORD—REVIEW COVER SHEET

Name of Site:	**PALOS VERDES SHELF SEDIMENT CONTAMINATION**	
Contact Person:	Carolyn Douglas, EPA Region IX	(415) 744-2343
Site Investigation:	Karen Johnson, Ecology and Environment, Inc.	(415) 981-2811
Documentation Record:	Karen Johnson, Ecology and Environment, Inc.	(415) 981-2811

Pathways, Components, or Threats Not Evaluated:

The groundwater pathway was not quantified because the effluent-affected sediments sit offshore and there are no useable aquifers beneath the sediments. The soil exposure and air pathways were not quantified because the sediments are located beneath 30 to 500 meters of ocean water.

HRS DOCUMENTATION RECORD

Name of Site: **PALOS VERDES SHELF SEDIMENT CONTAMINATION**

EPA ID#: CAD008242711

EPA Region: IX Date Prepared: June 25, 1997

Street Address of Site: Not Applicable

County and State: Los Angeles County, California

Topographic Map: Redondo Beach and San Pedro

Latitude: 33° 42' 38" N. Longitude: 118° 22' 32" W.
(Center of Source 1, Effluent-Affected Sediments)

Scores

Groundwater Pathway	0.00
Surface Water Pathway	100.00
Soil Exposure Pathway	0.00
Air Pathway	0.00
HRS SITE SCORE	50.00

REFERENCES

Reference Number	Description of References
1	Hazard Ranking System, 40 CFR 300, Appendix A. [not included with documentation record]
2	U.S. Environmental Protection Agency (EPA), June 1996, Superfund Chemical Data Matrix, EPA/540/R-96/028, Publication 9345.1-21. 6 pp.
3	Lee, H.J., October 1994, *The Distribution and Character of Contaminated Effluent-Affected Sediment, Palos Verdes Margin, Southern California*, Expert Report, U.S. Geological Survey. 104 pp.
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5	Drake, D.E., 1994, *The Natural Recovery of Contaminated Effluent-Affected Sediment on the Palos Verdes Margin: Background Information and Results of the USGS Natural Recovery Research*, Appendix A to *The Predictive Modeling of the Natural Recovery of the Contaminated Effluent-Affected Sediment, Palos Verdes Margin, Southern California.* 86 pp.
6	Los Angeles County Sanitation Districts, 1995, *Palos Verdes Ocean Monitoring Annual Report, 1994.* 12 pp.
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8	U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), National Ocean Service, 1993, *Sampling and Analytical Methods of the National Status and Trends Program, National Benthic Surveillance and Mussel Watch Projects, 1984-1992*, NOAA Technical Memorandum NOS ORCA 71, Volume I: Overview and Summary of Methods. 15 pp.
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14 Peakall, D.B., 1994, *Summary of the Effects of DDE and PCBs on the Avifauna of the Southern California Bight*, prepared for the NOAA Natural Resource Damage Assessment. 17 pp.

15 Sawyer, C.N. and P.L. McCarty, 1978, *Chemistry for Environmental Engineering*, McGraw-Hill Book Company, New York. 2 pp.

16 Erickson, M.D., 1985, *Analytical Method: The Analysis of By-Product Chlorinated Biphenyls in Air, Revision 2*, EPA-560/5-85-011. 5 pp.

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18 California Environmental Protection Agency (Cal-EPA) Office of Environmental Health Hazard Assessment, September 23, 1991, Press Release: "Toxic Warnings Issued on Some South Coast Sport Fish." 2 pp.

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22 U.S. Department of Commerce, NOAA, National Marine Fisheries Service (NMFS), 1992, Marine Recreational Fishery Statistics Survey, Pacific Coast, 1987-1989. 8 pp.

23 EPA, Office of Solid Waste and Emergency Response (OSWER), 1996, *Using Qualified Data to Document an Observed Release and Observed Contamination*, EPA 540-F-94-028, OSWER 9285.7-14FS. 18 pp.

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28 Title 50, Code of Federal Regulations, Part 17, Section 17.11 Endangered and threatened wildlife. 31 pp.

29 Thelander, Carl G. and Margo Crabtree, eds., 1994, *Life on the Edge: A Guide to California's Endangered Natural Resources*, BioSystems Books, Santa Cruz, CA. 15 pp.

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LIST OF ACRONYMS

ADL	Arthur D. Little, Inc.,
CDFG	California Department of Fish and Game
Cal-EPA	California Environmental Protection Agency
cm	centimeter
DDE	dichlorodiphenyldichloroethylene
DDD	dichlorodiphenyldichloroethane
DDMU	4,4'-DDD olefin
DDT	dichlorodiphenyltrichloroethane
EPA	U.S Environmental Protection Agency
ft^2	square feet
gpd	gallons per day
HRS	Hazard Ranking System
JWPCP	Joint Water Pollution Control Plant
km	kilometer
LACSD	Sanitation Districts of Los Angeles County
m	meters
m^2	square meters
m^3	cubic meters
mg/L	milligrams per liter
NIST	National Institute of Standards and Technology
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRDA	Natural Resource Damage Assessment
PCBs	polychlorinated biphenyls
ppb	parts per billion
ppm	parts per million
QA	Quality Assurance
sq km	square kilometer
USGS	U.S. Geological Survey
yd^3	cubic yards
°	degrees

CONVERSION FACTORS

Many of the documents cited in this Documentation Record use the metric system for presenting all measurements, including distance, area, and volume. The Documentation Record reports these data in their original units, except where comparison with units in the Hazard Ranking System (HRS) is required; measurements are only converted from metric where HRS factors are assigned.

1 kilometer	(km)	= 0.62 mile
1 centimeter	(cm)	= 0.39 inch
1 square meter	(m^2)	= 10.76 square feet
1 square kilometer	(sq km)	= 247 acres
1 cubic meter	(m^3)	= 1.307 cubic yards
1 metric ton	(Mg)	= 2,204.6 pounds
1 liter	(L)	= 0.264 gallon

SOURCE DESCRIPTION

2.2 Source Characterization

Source Description: Source 1 — Effluent-Affected Sediments

Sediments on the seafloor off the coast of the Palos Verdes Peninsula in Southern California have been impacted by the effluent discharged from the White's Point outfalls of the Sanitation Districts of Los Angeles County (LACSD) (ref. 3, p. ES-7). In 1937, LACSD began to discharge treated municipal and industrial wastewater through the White's Point ocean outfall on the Palos Verdes Shelf. Two new pipe diffuser systems were added in 1956 and 1966 to accommodate increasing discharges from the LACSD Joint Water Pollution Control Plant (JWPCP). The discharges of wastewater and suspended solids peaked in 1971 at about 360 million gallons per day and 167,000 metric tons per year, respectively (ref. 5, p. 1). The JWPCP effluent contained several pollutants—in particular, dichlorodiphenyltrichloroethane (DDT) and its metabolites and polychlorinated biphenyls (PCBs) (ref. 5, pp. 1 and 2; ref. 6, p. 1.9). After source control and treatment technologies improved in the early 1970s, the discharge rate of DDT, PCBs, and suspended solids through the outfalls decreased. Monitoring by LACSD showed that the amount of DDT and PCBs in surface sediments on the Palos Verdes Shelf began to decrease as the contaminated sediments were gradually covered with less contaminated effluent and natural sediment (ref. 5, p. 2). However, the concentrations of DDT (and dichlorodiphenyldichloroethylene [DDE], one of its metabolites) in surface sediments have remained higher than the emission rates from the JWPCP indicate they should be (ref. 5, pp. 2-3). A study on the natural recovery of the contaminated sediments suggests that older, buried DDE or DDT gets mixed into the upper surface through physical, chemical, or biological processes and is contributing to the current contaminant levels in the surficial sediment layer on the shelf (ref. 5, pp. 2-4). This historical "reservoir" of effluent-affected sediments is being evaluated as Source 1.

Source Location

The effluent-affected sediments of Source 1 exist on the Palos Verdes Shelf and extend down the continental slope to a water depth of at least 500 meters (m) (ref. 3, p. 120). The shelf extends seaward along a 12-kilometer (km) stretch of coastline on the southwest side of the Palos Verdes Peninsula, Los Angeles County, California, and ranges in width from 4 km near Point Fermin on the east to 1.5 km near Point Vicente on the west (see Figure 1) (ref. 3, p. ES-2; ref. 4). The continental slope lies south of the shelf and has a mean slope of 13° leading to the 800-m-deep San Pedro Basin (ref. 3, p. ES-2). East of Point Fermin, the peninsula runs northward into Los Angeles Harbor. The Palos Verdes Peninsula marks the southern edge of Santa Monica Bay (ref. 4).

Source Containment

Gas Release to Air

The contaminated sediments are covered by 30 to 500 meters of water (ref. 3, p. 120). Gases would need to volatilize through the water column to be available for a release to air. The air pathway is not being evaluated, so no gas release to air containment factor was assigned.

Particulate Release to Air

The contaminated sediments are covered by 30 to 500 meters of water (ref. 3, p. 120). The air pathway is not being evaluated, so no particulate release to air containment factor was assigned.

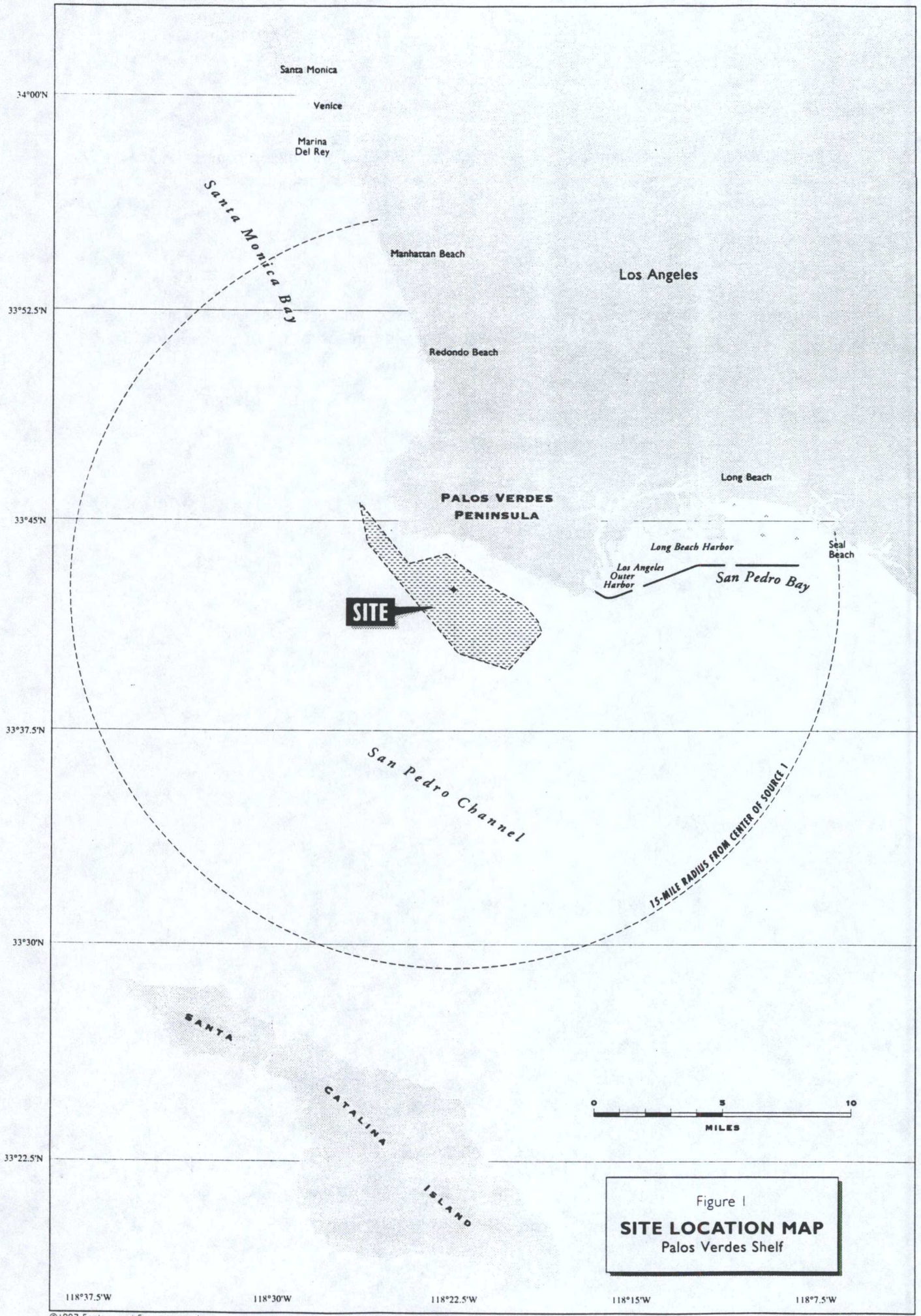

Figure 1

SITE LOCATION MAP

Palos Verdes Shelf

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Release to Groundwater

The effluent-affected sediments rest on the ocean floor with no containment features; however, the site is in the ocean with no freshwater aquifer beneath the contaminated sediments (ref. 7, p. 38). The groundwater pathway is not being evaluated, so no groundwater pathway containment factor was assigned.

Release to Surface Water

Contaminated sediments exist on the ocean floor with no cover, liner, or other containment feature (ref. 3, pp. 105, 108, 111, and 117). A surface water containment factor of 10 was assigned (ref. 1, Table 4-2).

2.4.1. Hazardous Substances

As part of a Natural Resource Damage Assessment (NRDA) completed by the U.S. National Oceanic and Atmospheric Administration (NOAA), the U.S. Geological Survey (USGS) conducted a multidisciplinary study to characterize the geometry of the effluent-affected sediments and the corresponding concentrations of DDT and PCBs on the Palos Verdes Shelf (ref. 3, p. ES-1).

The USGS sediment study included, among other things, collection and analysis of 37 sediment core samples for DDT and PCBs in July 1992 (ref. 3, p. 3). These samples were evaluated to determine the presence of hazardous substances and the hazardous waste quantity in Source 1. Of these 37 sediment core samples, 28 document the presence of hazardous substances in Source 1, specifically, PCBs and DDT (both 2,4- and 4,4-DDT) and its metabolites (2,4- and 4,4-DDE; 2,4- and 4,4-DDD; 4,4-DDD olefin [DDMU]). Table 1a describes the samples selected to represent background conditions; Table 1b presents the analytical results for total PCBs and the seven DDT isomers/metabolites for these samples. Table 2a describes the samples documenting the presence of hazardous substances in Source 1; Table 2b presents the analytical results for total PCBs and the seven DDT isomers/metabolites for these samples.

Table 2b lists the analytical results for surface increments (0-2 or -4 cm) and the increment at depth that contained the highest concentration of at least one of the hazardous substances for that core sample. For some core samples, more than two non-surface increment samples are reported in the table because different increments contained the highest concentration of different compounds. At least one hazardous substance in each sample increment included on the table meets the requirements of an observed release described in ref. 1, Table 2-3 (see also discussion of observed release criteria in Section 4.1.1.2.)

DDT and PCBs

The pesticide DDT was discovered in 1874 and saw widespread use as a delousing and mosquito control agent during World War II (ref. 13, p. 16-1). DDT degrades or metabolizes to DDE and dichlorodiphenyldichloroethane (DDD). Total DDT consists of the sum of six individual compounds: p,p'-DDE; o,p'-DDE; p,p'-DDD; o,p'-DDD; p,p'-DDT; and o,p'-DDT. p,p'-DDE is the dominant compound of DDT in the environment and the concentration of total DDT is normally little different from the concentration of p,p'-DDE alone (ref. 3, p. ES-1; ref. 13, p. 16-1; ref. 14, p. 2). [Chemistry note: the o and p in the above compound abbreviations refer to the ortho and para placement for di-substituted chlorinated compounds. These abbreviations can also be listed by number—2 for ortho or 4 for para (ref. 15, p. 126).]

There are 209 different compounds that can be formed when basic biphenyl is chlorinated. These various compounds are called congeners (ref. 14, p. 2; ref. 16, p. 2). The stability of the various congeners of PCBs varies greatly; however, in general, the more highly chlorinated compounds are the most stable. Many of these congeners can persist in the environment for many years (ref. 14, p. 2).

Sampling and Analysis Methodologies

Figure 2 shows the station numbers for all 60 core samples collected by the USGS (only 37 of the 60 were analyzed for DDT and PCBs). The following numbering system was used by the USGS for this study: Each coring station was assigned a three-digit number beginning with a 5. The numbering system proceeded roughly from west to east across the study area (ref. 3, p. 3). Some of the coring stations were sampled in both 1992 and 1993. Individual core samples collected in 1992 were given a three-digit designation beginning with a 1. Core samples taken in 1993 were assigned a 3-digit designation beginning with a 2. Standard box cores (20-cm by 30-cm surface area) were given a designator "B,"

giant box cores (50-cm by 50-cm) were given a designator "W," and gravity cores were given a designator "G." The last digit in the sample number relates to the attempt number (sometimes more than one attempt was made to get a particular core sample) at a given location. A typical sample number is 156-B1 (ref. 3, p. 5).

The sediment core samples collected by the USGS were analyzed by Arthur D. Little, Inc., (ADL) in Cambridge, Massachusetts. The chemistry performed at ADL was subject to a Quality Assurance (QA) Plan for the Southern California NRDA (ref. 9, p. 1). According to the QA Plan, no official procedures have been approved by regulatory agencies for low-level (i.e., parts per billion [ppb]) analysis of DDT compounds or PCB congeners in marine sediments or biological tissue; therefore no particular analytical method was specified (ref. 11, p. 21). The laboratory was required to provide written protocols for the analytical methods used and to participate in interlaboratory comparison exercises managed by the National Institute of Standards and Technology (NIST) for NOAA and the U.S Environmental Protection Agency (EPA) (ref. 11, p. 17; ref. 12). Laboratory and validation qualifiers were attached to sample results to assist in data quality interpretation. These qualifiers are presented, where appropriate, in Tables 1b and 2b. Any result attached to an "R" qualifier was not added to the table. An "R" means the results are unreliable and should not be used (ref. 9, p. v).

Total PCBs were calculated by summing the concentrations of PCB congeners 8, 18, 28, 44, 52, 66, 101, 105, 118, 128, 138, 153, 170, 180, 187, 195, 206, and 209, and then multiplying by two (ref. 8, p. I-35; ref. 9, p. vi). If a congener result was reported as non-detect, then one-half of the method detection limit was used in the summation for total PCBs. A laboratory qualifier of NR was used if more than one-half of the total was contributed by non-detect results or results less than the method detection limit (ref. 9, p. vi).

Table 1a

July 1992 USGS Sediment Core Samples Representing Background Conditions

Station Number	Core Number	Longitude (decimal degrees W)	Latitude (decimal degrees N)	Water Depth (m)	Length of Core (cm)[1]
506	163-B1	118.5287	33.7975	584	8
547	143-B1	118.3563	33.7208	26	32
554	125-B2	118.3463	33.7173	28	39
563	128-B1	118.3354	33.7100	29	32

[1] Length of core based on distance between sediment surface and the lower edge of the lowest increment for which hazardous substances were analyzed (listed on Table 1b).

Table 1b

July 1992 USGS Sediment Core Sample Results Showing Background Concentrations (in ppb)

Station	Core No.	Increment (cm)	Total PCBs	DDMU	2,4-DDE	4,4-DDE	2,4-DDD	4,4-DDD	2,4-DDT	4,4-DDT	Ref.
506	163-B1	0-4	125	36.1	72.7	876 SC/J	21.4	NA	2.05 NCA	7	9, pp. 89-96
		4-8	169	37.4	117	1,150 SC/J	NA	NA	1.75	8.75	
547	143-B1	0-4	70	72.6 SC	49.1	319 SC	11.6	NA	0.462 NCA	5.28 J	9, pp. 65-72
		4-8	110	116 SC	77.8	530 SC	17.8	NA	0.481 NCA	41.6 J	
		8-12	93.8	92.5 SC	61.5	396 SC	14.6	NA	0.281 J	11.8 J	
		12-16	30.9	45.2	19.8	130 SC	3.97 J	NA	0.396 U	0.693 J	
		16-20	85.4	94.6 SC	55.9	337 SC	14.7	NA	0.351 J/NCA	17.1 J	
		20-24	89.6	172 SC	60.2	348 SC	NA	NA	0.487 NCA	8.36 J	
		24-28	82.2	111 SC	53.3	317 SC	NA	NA	0.686	26 J	
		28-32	45.3	56.9 SC	25.6	154 SC	NA	NA	0.415 NCA	6.61 J	
554	125-B2	0-2	114	173 SC	82	531 SC	16.5	NA	0.114 J	13.8 J	9, pp. 33-40
		2-4	110	171 SC	82	539 SC	16.8	NA	0.486 J	3.75 J	
		4-6	155	288 SC	76.7 SC	726 SC	19.1	NA	0.391 J	12.8	
		6-8	117	218 SC	63.6	593 SC	14.6	NA	0.562 J	78.1	
		8-10	115	200 SC	51.6 SC	521 SC	13.8	44.9	0.28 J	106 SC	
		10-13	56.8	158	31.7	229 SC/J	10.2	NA	0.729 U	11.6	
		13-16	55.2	112	32.1	193 SC	8.41	NA	0.199 J NCA	2.55 J	
		16-20	90.7	99.2 SC	54.1	258 SC	14	NA	0.269 J NCA	3.75 J	
		20-24	211	1,570 SC	94.8	719 SC	29.9	NA	2.85	289 SC	
		24-28	190	1,230 SC	73.1	389 SC	29.2	NA	1.11 U	23.1	
		28-32	136	731 SC	39.5	292 SC	17.3	NA	0.225 J	182	
		32-36	73.1	435 SC	25.1	222 SC	10.1	NA	1.15 U	15.9	
		36-39	96.9	426 SC	41.1	241 SC	14.2	NA	0.751 U	1.38 J	

Table 1b

July 1992 USGS Sediment Core Sample Results Showing Background Concentrations (in ppb)

Station	Core No.	Increment (cm)	Total PCBs	DDMU	2,4-DDE	4,4-DDE	2,4-DDD	4,4-DDD	2,4-DDT	4,4-DDT	Ref.
563	128-B1	0-4	50.1	85.8	42.9	410 SC	18.6	NA	0.488 U	51.1	9, pp. 41-48
		4-8	46.5	88.3	50.8	369 SC	21.7	NA	0.454 U	24.6	
		8-12	26.6	0.313 U	26.7	217 SC	NA	NA	0.416 U	1.92 U	
		12-16	29	57.9 SC	28.9	210 SC	NA	NA	0.425 U	1.96 U	
		16-20	47.7	168 SC	30.7	261 SC	15.5	NA	0.498 U	34.5	
		20-24	26.8	80.3	18.6	133 SC	8.13	NA	0.413 U	5.57	
		24-28	54.9	218 SC	35.1	331 SC	NA	NA	0.511 U	26.6	
		28-32	35.2	147 SC	25.7	235 SC	10.3	NA	0.403 U	38.4	

▒ Analyte concentration (or method detection limit if followed by "U") used for comparison to document the presence of hazardous substances.

NA = Not available.

Data Qualifiers (ref. 9, p. vi):

U Analyte was not detected. Reported value is the method detection limit.

J Confirmed as present, but at a concentration less than the method detection limit.

NCA Analyte could not be confirmed on the second GC column because of analytical interferences.

SC Surrogate was diluted out of range. Result was corrected for the surrogate recovery in the undiluted analysis of the same sample extract. Data validators determined that the data met accuracy and precision requirements.

/J The reported concentration may not be accurate, as judged by associated calibration, reference material, and/or matrix spike results, or precise, as judged by associated replicate results. Overall goals for results at least five times above the method detection limit were approximately ±50% for precision and ±35% for accuracy.

Table 2a

July 1992 USGS Sediment Core Samples Documenting the Presence of Hazardous Substances in Source 1

Station Number	Core Number	Longitude (decimal degrees W)	Latitude (decimal degrees N)	Water Depth (m)	Length of Core (cm)[1]
514	160-B1	118.4382	33.7585	53	28
518	106-B1	118.4234	33.7343	89	12
519	159-B1	118.4319	33.7333	252	8
524	102-B1	118.4099	33.7211	233	4
532	148-B1	118.3989	33.7225	137	24
533	149-B1	118.3979	33.7205	167	20
534	173-B1	118.3799	33.7300	38	44
536	174-B1	118.3864	33.7233	65	36
539	111-B1	118.3731	33.7243	44	36
542	113-B1	118.3864	33.7135	207	16
544	115-B2	118.3919	33.6983	504	8
550	169-B1	118.3638	33.7150	57	34
552	146-B1	118.3689	33.7070	192	16
553	130-B1	118.3791	33.7008	376	4
555	132-B1	118.3494	33.7125	42	36
556	147-B3	118.3526	33.7083	57	42
557	127-B1	118.3549	33.7041	104	24
559	136-B1	118.3626	33.6980	340	16
564	171-B1	118.3336	33.7000	56	36
566	122-B1	118.3404	33.6933	182	12
570	121-B1	118.3214	33.6871	74	16
571	117-B4	118.3248	33.6840	156	8
572	155-B2	118.3298	33.6760	417	20
574	153-B1	118.3158	33.6898	58	16
577	120-B1	118.3131	33.6830	66	16
581	137-B1	118.3786	33.6938	471	10
583	138-B2	118.3672	33.6725	702	8
584	139-B2	118.3346	33.6626	614	8

[1] Length of core based on the distance between the sediment surface and the lower edge of the increment in which the highest concentration of hazardous substances was identified (listed on Table 2b).

Table 2b

July 1992 USGS Sediment Core Sample Results
Documenting the Presence of Hazardous Substances (in ppb)

Station	Core No.	Increment (cm)	Total PCBs	DDMU	2,4-DDE	4,4-DDE	2,4-DDD	4,4-DDD	2,4-DDT	4,4-DDT	Ref.
514	160-B1	0-4	356	367 SC	345 SC	3,200 SC/J	52.2	92.4	1.99 NCA	6.88	9, pp. 89-96
		16-20	780	2,280 SC	1,210 SC	10,800 SC/J	NA	174	4.04	15.1	
		20-24	691	2,320 SC	1,190 SC	12,100 SC/J	NA	279 SC/J	4.82 NCA	87.7	
		24-28	427	NA	NA	6,990 SC/J	NA	NA	NA	100	
518	106-B1	0-4	331	198 SC	233 SC	2,060 SC	NA	119 SC	5.23	96.7	9, pp. 1-8
		8-12	851	NA	NA	NA	NA	NA	NA	111	
519	159-B1	0-4	2,790	71.5 SC	228 SC	2,270 SC	NA	NA	7.61 NCA	217 SC	9, pp. 89-96
		4-8	490	NA	322 SC	2,520 SC	NA	NA	NA	NA	
524	102-B1	0-2	433	166	295 SC	3,180 SC	81.8	206	8.06	159/J	9, pp. 1-8
		2-4	624	411 SC	486 SC	4,460 SC	NA	NA	11.4	136/J	
532	148-B1	0-4	6,660	768 SC	596 SC	4,300 SC	177	NA	1.419	447 SC	9, pp. 73-80
		16-20	3,130	7,310 SC	2,580 SC	13,000 SC	500 SC	NA	22.8	242	
		20-24	NA	NA	3,740 SC	18,400 SC	NA	NA	NA	708 SC	
533	149-B1	0-4	930	453 SC	729 SC	5,890 SC	NA	NA	5.95	129	9, pp. 73-80
		16-20	4,310	4,340 SC	3,930 SC	14,300 SC	918 SC	1,750 SC	24	959 SC	
534	173-B1	0-4	246	345 SC	72.8 SC/J	1,070 SC	29.2	NA	1.21 NCA	5.73	9, pp. 105-112
		24-28	492	609 SC	254 SC	2,500 SC/J	NA	128 SC	2.37 J	80.1 SC	
		40-44	818	1,940 SC	311 SC	3,470 SC	100 SC/J	182 SC	3.48	120 SC	

Table 2b

July 1992 USGS Sediment Core Sample Results
Documenting the Presence of Hazardous Substances (in ppb)

Station	Core No.	Increment (cm)	Total PCBs	DDMU	2,4-DDE	4,4-DDE	2,4-DDD	4,4-DDD	2,4-DDT	4,4-DDT	Ref.
536	174-B1	0-4	511	641 SC/J	288 SC/J	3,800 SC/J	NA	196 SC/J	4.27 NCA/J	150/J	9, pp. 105-112
		24-28	4,970	11,200 SC/J	7,360 SC/J	41,600 SC/J	1,220 SC/J	NA	32.5 J	2,140 SC/J	
		32-36	5,040	9,020 SC/J	6,330 SC/J	32,600 SC/J	882 SC/J	NA	20.4 J	163 SC/J	
539	111-B1	0-4	419	670 SC	348 SC	2,600 SC/J	78.3	NA	4.63	186 SC/J	9, pp. 9-16
		32-36	553	785 SC	622 SC	3,070 SC/J	NA	NA	3.29	92 SC/J	
542	113-B1	0-4	163	142 SC	132 SC	1,210 SC	NA	130 SC	9.58	224 SC	9, pp. 9-16
		12-16	19	20.9	12 SC	104 SC	NA	NA	0.802 U	14.9	
544	115-B2	0-4	335	124	342 SC	3,140 SC/J	NA	NA	3.82 NCA	40.8	9, pp. 17-24
		4-8	503	222 SC	639 SC	8,150 SC/J	NA	412 SC	22.3	255 SC	
550	169-B1	0-2	987	1,340 SC	1,060 SC	8,310 SC	177	NA	12.6	1,460 SC/J	9, pp. 89-96
		32-34	18,400	NA	NA	NA	2,130 SC	NA	NA	838	
552	146-B1	0-4	623	277 SC	487 SC	5,550 SC/J	108	NA	3.25 J	117 SC	9, pp. 65-72
		12-16	3,730	3,480 SC	3,610 SC	34,000 SC	730	NA	32.5	432	
553	130-B1	0-4	698	169 SC	340 SC	4,150 SC	NA	NA	5.22	43.6 SC/J	9, pp. 41-48
555	132-B1	0-2	278	275 SC	220 SC	3,630 SC	54.1	NA	3.34	143 J	9, pp. 49-56
		34-36	604	NA	NA	NA	NA	NA	2.95	NA	
556	147-B3	0-2	1,550	1,700 SC	1,290 SC	11,350 SC	NA	NA	10.4	895 SC	9, pp. 65-72
		26-28	2,920	NA	NA	NA	326	NA	5.58	333	
		40-42	19,900	NA	NA	NA	2,770	NA	25.2	NA	

Table 2b

July 1992 USGS Sediment Core Sample Results
Documenting the Presence of Hazardous Substances (in ppb)

Station	Core No.	Increment (cm)	Total PCBs	DDMU	2,4-DDE	4,4-DDE	2,4-DDD	4,4-DDD	2,4-DDT	4,4-DDT	Ref.
557	127-B1	0-2	1,160	975 SC	1,020 SC	8,690 SC	204	NA	13.4	818 SC	9, pp. 33-40
		22-24	10,500	NA	NA	NA	NA	NA	55.4	NA	
559	136-B1	0-2	348	150	250	1,400 SC/J	NA	NA	12.0 NCA	108	9, pp. 49-56
		14-16	1,730	557 SC	NA	NA	339 SC	NA	NA	NA	
564	171-B1	0-2	1,800	2,020 SC	2,610 SC	20,200 SC	NA	1,340 SC	25.1	496 SC/J	9, pp. 97-104
		34-36	20,300	NA	NA	126,000 SC/J	3,090 SC	NA	172	4,220 SC	
566	122-B1	0-4	474	253 SC	336 SC	4,590 SC	103	491 SC	7.05 NCA	136	9, pp. 25-32
		4-8	1,940	781 SC	1,480 SC	11,300 SC	481 SC	NA	NA	969 SC	
		8-12	221	110	155 SC	1,780 SC	NA	157 SC	14.2	483 SC	
570	121-B1	0-4	422	186 SC	437 SC	2,130 SC	NA	NA	14.6	492 SC	9, pp. 17-24
		12-16	3,680	1,880 SC	3,430 SC	12,200 SC	686 SC	NA	13.8	216 SC	
571	117-B4	0-4	1,160	380 SC	1,270 SC	11,800 SC/J	NA	NA	7.84 J	161 SC	9, pp. 17-24
		4-8	2,890	1,960 SC	3,110 SC	25,900 SC/J	783 SC	NA	19.4	935 SC	
572	155-B2	0-4	910	364 SC	973 SC	11,100 SC/J	NA	NA	795 SC	1,000 SC	9, pp. 81-88
		16-20	945	413 SC	1,100 SC	11,300 SC/J	NA	NA	989 SC	1,000 SC	
574	153-B1	0-4	1,300	508	439	3,280 SC/J	NA	NA	30.3 J	866 SC	9, pp. 73-80
		12-16	5,890	17,700 SC	8,350 SC	33,000 SC/J	2,790 SC	NA	1,420 SC	22,400 SC/J	
577	120-B1	0-4	317	149 SC	241 SC	2,620 SC/J	49.9	142	1.86 J	199 SC	9, pp. 17-24
		8-12	1,470	479 SC	1,080 SC	7,700 SC	113 SC/J	NA	16.9	97.4 J	
		12-16	1,290	490 SC	1,140 SC	7,600 SC	73.5 SC/J	NA	7.65	275 SC/J	

Table 2b

July 1992 USGS Sediment Core Sample Results
Documenting the Presence of Hazardous Substances (in ppb)

Station	Core No.	Increment (cm)	Total PCBs	DDMU	2,4-DDE	4,4-DDE	2,4-DDD	4,4-DDD	2,4-DDT	4,4-DDT	Ref.
581	137-B1	0-2	483	192	NA	NA	97.5	NA	6.15	75.4	9, pp. 58-65
		6-8	539	185	641	3,100 SC	103	NA	NA	107 J	
		8-10	652	199 SC	557 SC	5,220 SC	NA	NA	25.6	335 SC	
583	138-B2	0-4	339	125	263 SC/J	4,910 SC/J	NA	NA	4.49	75.0	9, pp. 58-65
		4-8	609	142	570 SC	7,320 SC/J	NA	364 SC	7.64	112	
584	139-B2	0-4	296	87.5	221 SC	1,740 SC	NA	151 SC	11.8	109	9, pp. 58-65
		4-8	552	283 SC	574 SC	3,930 SC	204 SC	369 SC	115	265 SC	

Analyte concentration meets the definition of an observed release (same criteria used to document the presence of hazardous substances) (Ref 1, Table 2-3). If data is qualified with a /J, an adjustment value was applied as described in Ref. 23. For 4,4-DDD and 4,4-DDE, the sample result was multiplied by 10 before applying the criteria in Ref. 1, Table 2-3. For 4,4-DDT, an adjustment factor of 12.82 was applied (ref. 23, pp. 7, 8, 16).

NA = Not available.

Data Qualifiers (ref. 9, p. vi):

U — Analyte was not detected. Reported value is the method detection limit.

J — Confirmed as present, but at a concentration less than the method detection limit.

NCA — Analyte could not be confirmed on the second GC column because of analytical interferences.

SC — Surrogate was diluted out of range. Result was corrected for the surrogate recovery in the undiluted analysis of the same sample extract. Data validators determined that the data met accuracy and precision requirements.

/J — The reported concentration may not be accurate, as judged by associated calibration, reference material, and/or matrix spike results, or precise, as judged by associated replicate results. Overall goals for results at least five times above the method detection limit were approximately ±50% for precision and ±35% for accuracy.

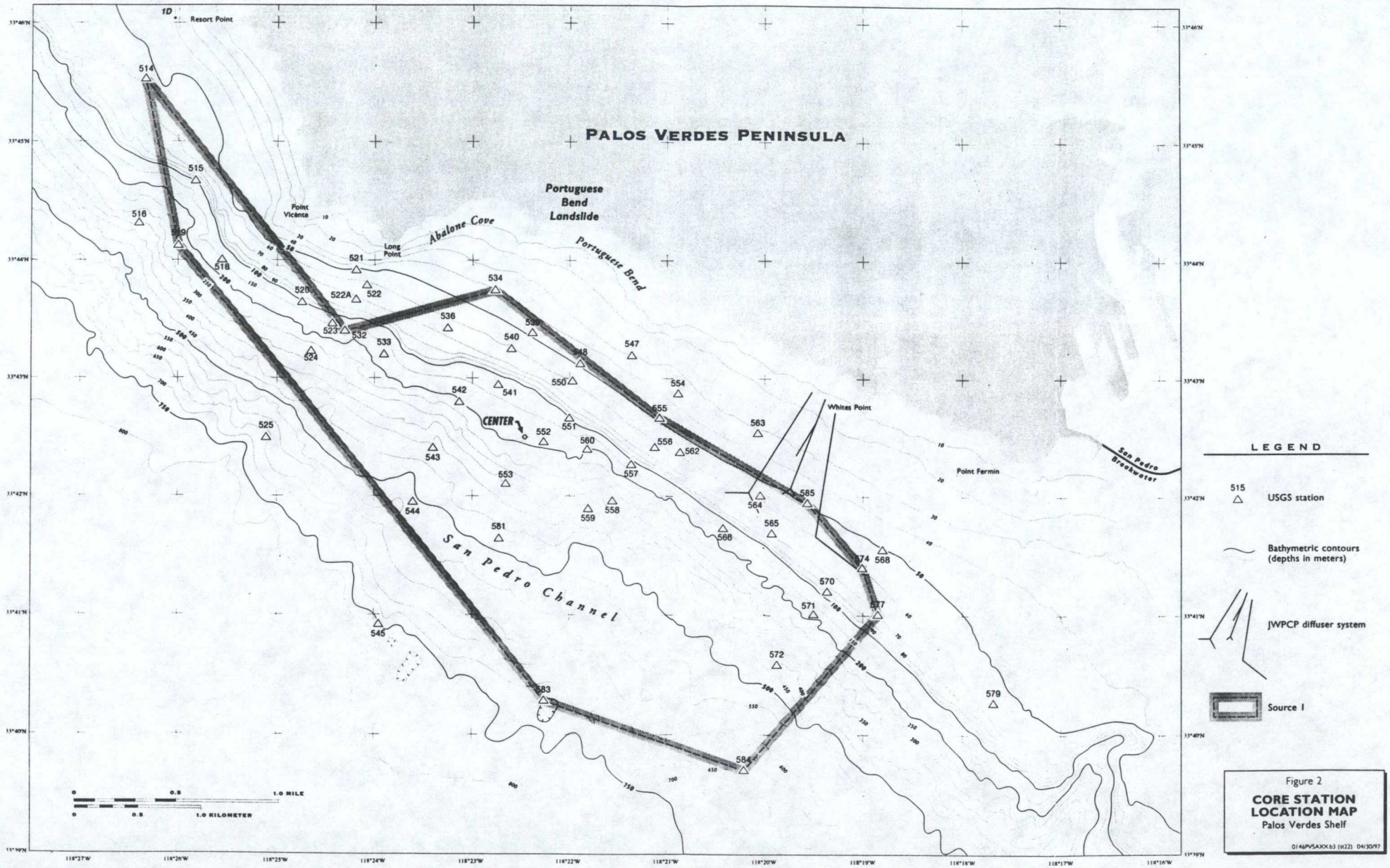
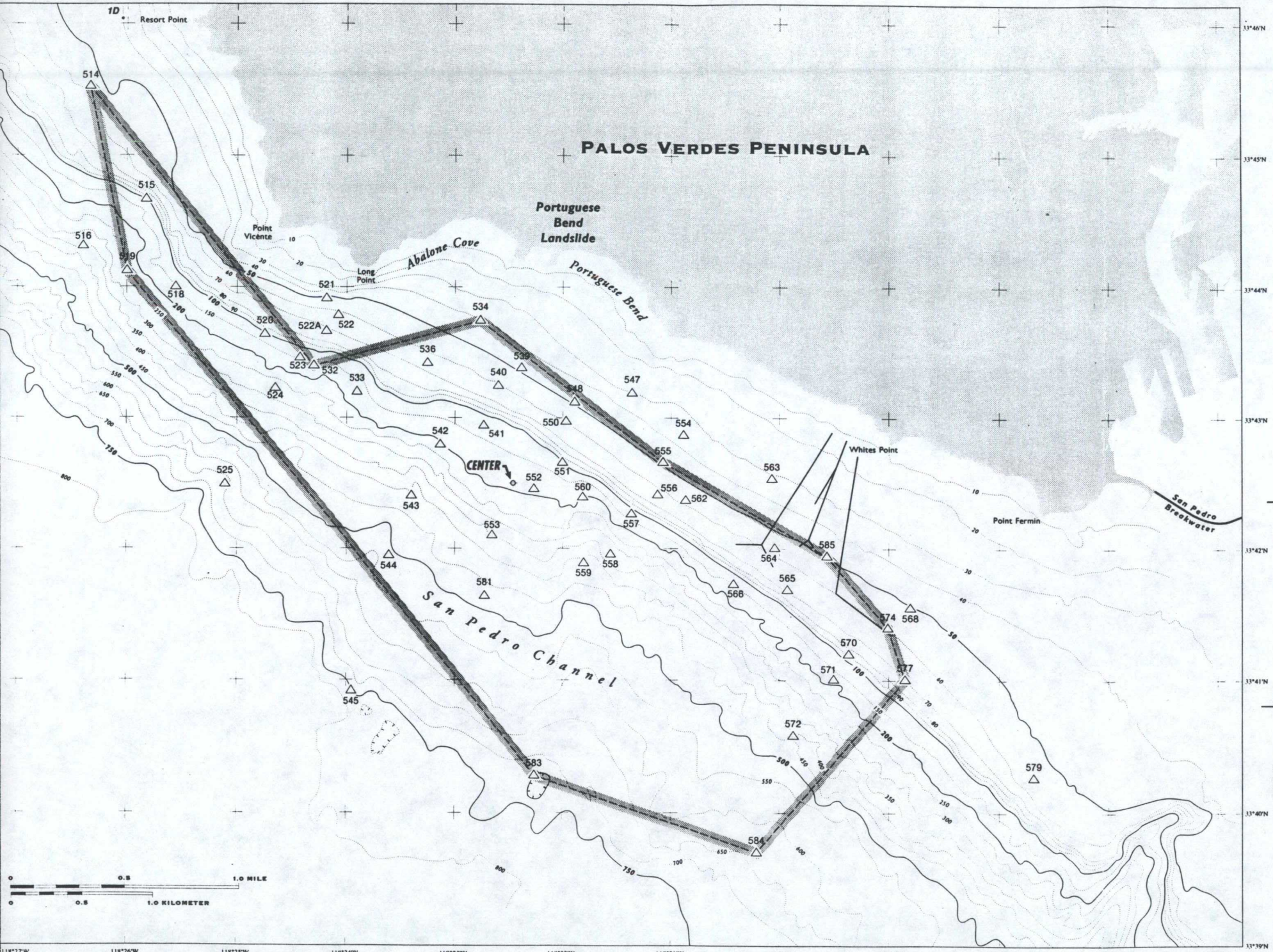


Figure 2

CORE STATION LOCATION MAP

Palos Verdes Shelf

0146PVSAXX.b3 (tt22) 04/30/97


1D
Resort Point
PALOS VERDES PENINSULA
Portuguese Bend Landslide
Point Vicente
Abalone Cove
Long Point
Portuguese Bend
Whites Point
Point Fermin
San Pedro Breakwater
CENTER
San Pedro Channel
514
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33°46'N
33°45'N
33°44'N
33°43'N
33°42'N
33°41'N
33°40'N
33°39'N
118°27'W
118°26'W
118°25'W
118°24'W
118°23'W
118°22'W
118°21'W
118°20'W
118°19'W
118°18'W
118°17'W
118°16'W
0 0.5 1.0 NILE
0 0.5 1.0 KILOMETER

2.4.2 Hazardous Waste Quantity

Tier A: Hazardous Constituent Quantity

There is insufficient data to document hazardous constituent quantity for Source 1; therefore, a 0 is assigned for this source (ref. 1, Section 2.4.2.1.1).

Hazardous Constituent Quantity Value: 0

Tier B: Hazardous Wastestream Quantity

There is insufficient data to document hazardous wastestream quantity for Source 1; therefore, a 0 is assigned for this source (ref. 1, Section 2.4.2.1.2).

Hazardous Wastestream Quantity Value: 0

Tier C: Source Volume

For this evaluation, the volume of PCB- and DDT-contaminated sediments was calculated using the sampling data from the 1992 USGS coring activity (ref. 10, p. 1). All core samples in which at least one sample increment from the core contained PCBs or one of the DDT isomers/metabolites at a concentration at least three times greater than the concentration of the same hazardous substance at the same increment in the background cores were used to calculate the volume of Source 1; 28 cores met this criteria and were used in the volume calculations.

All 28 sample locations were mapped using Golden Software's Surfer™ for Windows, Version 5.03. Table 2a contains the station number, latitude and longitude, and the thickness used to calculate the volume based on the lower edge of the deepest sampling increment reported in Table 2b. Because there is evidence that the surface of the sediments in the area have been contaminated at least in part by the upward migration of hazardous substances buried historically, the surface of Source 1 was considered the surface of the ocean sediments (ref. 5, p. 3 and 4). The lower edge of Source 1 was evaluated as the lower edge of the sample increment with the highest concentration of hazardous substances. For example, on Table 2b the highest concentration of either PCBs or the DDT isomers/metabolites at Core Station 552 was found in the 12- to 16-cm sample increment; therefore, the thickness of Source 1 at Core Station 552 is 16 cm.

Surfer™ calculated the volume within the boundary of the points and thicknesses four ways: by Trapezoidal Rule, Simpson's Rule, and Simpson's 3/8 Rule, and by using cut and fill volumes. Although the methods produced different results out to five significant digits, all four methods agreed that the volume of the sediment layer was approximately 7.0 million cubic meters (m^3) (ref. 10, p. 4).

The above sediment volume calculation is supported by volume estimates conducted for the USGS sediment study. Within the USGS study, the volume of the effluent-affected sediment layer was estimated four ways (ref. 3, pp. 18-28). The values obtained are presented in Table 3 (ref. 3, p. 73). The chirp profiling method produced a result much smaller than the other three methods because it was only able to survey part of the sediment layer (ref. 3, p. 27). The average volume from the other three calculations is $(8.95+9.83+7.8)/3 = 8.9$ million m^3, which is similar to the value calculated with the Surfer™ software (ref. 3, p. 73; ref. 10, p. 4). The volume calculated by Surfer™ is smaller than the other volume because only the distance between the surface and the depth of highest hazardous substance concentrations was used as the thickness of Source 1. In addition, a "blanking" file was used to cut off the edges of the shape to be calculated rather than extrapolating the edges out to a 0-m thickness (ref. 10, pp. 1 and 3).

To assign a waste quantity factor value for Source 1, the effluent-affected sediments, 7.0 million m^3 was converted to 9.2 million cubic yards (yd^3) by multiplying by 1.307. For a source type of "other", the volume of Source 1 was converted to hazardous waste quantity by dividing by 2.5; therefore, the volume of 9.2 million yd^3 converts to a hazardous waste quantity value of 3.68×10^6 (ref. 1, Table 2-5).

Dimension of Source (yd^3): 9.2 million

Volume Assigned Value: 3.68×10^6

Table 3

Estimates of the Volume of the Effluent-Affected Sediment Layer Palos Verdes Shelf

Water Depth (m)	Using 1989 LACSD p,p'-DDE measurements (million m^3)	Using 1992 USGS Chirp Profiling (million m^3)	Using 1992 USGS Density Logs (million m^3)	Using 1992 USGS Data and Geostatistical Analysis (million m^3)	Using 1992 USGS Data from Table 2b and Surfer™ Software
30-50	4.61		4.33		
60-100	1.88		2.32	6.6	
100-200	0.74		0.81		
200-400	1.25		1.15	1.2	
>400	0.47		1.21		
Total	8.95	3.2	9.83	7.8	7.0

DDE = dichlorodiphenyldichloroethylene
LACSD = Los Angeles County Sanitation Districts
m = meters
m^3 = cubic meters
USGS = U.S. Geological Survey

Tier D: Source Area

Because the volume of Source 1 was adequately determined, the area was not calculated (ref. 1, Section 2.4.2.1.3).

Area Assigned Value: 0

Source Hazardous Waste Quantity

The Source Hazardous Waste Quantity for Source 1 is derived from Tier C: Volume (ref. 1, Section 2.4.2.1.5).

Source Hazardous Waste Quantity: 3.68×10^6

GROUNDWATER MIGRATION PATHWAY

3.0.1 General Considerations

There are no fresh water-bearing sediments in the southwestern Palos Verdes Hills or in the offshore area of the Palos Verdes Shelf; therefore, there is no pathway for hazardous substances to migrate from the effluent-affected sediments to the groundwater aquifers of the Los Angeles Coastal Plain (ref. 7, p. 38).

Groundwater Pathway Score: 0

SURFACE WATER MIGRATION PATHWAY

4.1 OVERLAND/FLOOD MIGRATION COMPONENT PATHWAY DESCRIPTION

4.1.1 General Consideration

4.1.1.1 Definition of Hazardous Substance Migration Path for Overland/Flood Component

The source of hazardous substances for release to the surface water pathway is a body of effluent-affected sediments resting on the ocean floor at water depths of between 30 and 500 m (ref. 3, pp. ES-7 and 120). These sediments contain PCBs and isomers and metabolites of DDT in concentrations significantly higher than background levels (ref. 3, pp. 53-62; ref. 9, pp. 1-120). The interface between hazardous substances in the surface layer of the effluent-affected sediments and the ocean provides the mechanism for release of hazardous substances to the ocean; therefore, the surface of Source 1 is the probable point of entry of hazardous substances to surface water.

Shelf currents are generally slow, averaging 7 to 10 centimeters per second (cm/s), and trend to the northwest along bathymetric lines (ref. 6, p. 3.3). The effluent containing hazardous substances discharged through outfall diffusers at a depth of 61 m (ref. 6, p. 3.2). The effluent-affected sediment deposit is an oval mound whose long axis extends northwest along the 50 to 60 meter bathymetric line. The mound's southeastern end rises relatively steeply, and a long gentle slope tapers off to the northwest of the outfall system. The side of the mound nearest to shore ends abruptly at a water depth of about 30 meters; however, the offshore flank drapes over the shelf break and extends down the continental slope (ref. 6, p. 3.3). The shape of the effluent-affected sediment deposit shows that although the dominant current flows to the northwest there is some mixing by waves and storms.

Because there is no clearly defined flow to the water above the effluent-affected sediments, the target distance limit for the surface water migration path is an arc with a radius of 15 miles (or 24 km) extending from the center of the effluent-affected sediment deposit as shown on Figure 1 (ref. 1, Section 4.1.1.2). Using the half-way point between the latitudes for core stations 514 and 584 and the longitudes for core stations 514 and 577, listed on Table 2a and shown on Figure 2, the center of the sediment deposit was calculated as latitude 33° 42' 38" N., longitude 118° 22' 32" W. (ref. 3, pp. 50-62 and 78).

4.1.1.2 Observed Release

Direct Observation

An observed release by direct observation has not been documented for this site.

Chemical Analysis

An observed release by chemical analysis can be documented to surface water using the 1992 USGS sediment core data. Table 4a describes the samples selected to represent background conditions; Table 4b presents the analytical results for total PCBs and the seven DDT isomers/metabolites for these samples. The shaded values on Table 4b are the highest concentration (or highest method detection limit for undetected results) of the four background core samples for a particular hazardous substance at a particular sample increment and were used in applying the conditions for documenting an observed release presented in ref. 1, Table 2-3.

Table 4a

July 1992 USGS Sediment Core Samples Representing Background Conditions

Station Number	Core Number	Longitude (decimal degrees W)	Latitude (decimal degrees N)	Water Depth (m)	Length of Core (cm)[1]
506	163-B1	118.5287	33.7975	584	8
547	143-B1	118.3563	33.7208	26	32
554	125-B2	118.3463	33.7173	28	39
563	128-B1	118.3354	33.7100	29	32

[1] Length of core based on distance between sediment surface and the lower edge of the lowest increment for which hazardous substances were analyzed (listed on Table 4b).

Table 4b

1992 USGS Sediment Core Sample Results Showing Background Concentrations (in ppb)

Station	Core No.	Increment (cm)	Total PCBs	DDMU	2,4-DDE	4,4-DDE	2,4-DDD	4,4-DDD	2,4-DDT	4,4-DDT	Ref.
506	163-B1	0-4	125	36.1	72.7	876 SC/J	21.4	NA	2.05 NCA	7	9, pp. 89-96
		4-8	169	37.4	117	1,150 SC/J	NA	NA	1.75	8.75	
547	143-B1	0-4	70	72.6 SC	49.1	319 SC	11.6	NA	0.462 NCA	5.28 J	9, pp. 65-72
		4-8	110	116 SC	77.8	530 SC	17.8	NA	0.481 NCA	41.6 J	
		8-12	93.8	92.5 SC	61.5	396 SC	14.6	NA	0.281 J	11.8 J	
		12-16	30.9	45.2	19.8	130 SC	3.97 J	NA	0.396 U	0.693 J	
		16-20	85.4	94.6 SC	55.9	337 SC	14.7	NA	0.351 J/NCA	17.1 J	
		20-24	89.6	172 SC	60.2	348 SC	NA	NA	0.487 NCA	8.36 J	
		24-28	82.2	111 SC	53.3	317 SC	NA	NA	0.686	26 J	
		28-32	45.3	56.9 SC	25.6	154 SC	NA	NA	0.415 NCA	6.61 J	
554	125-B2	0-2	114	173 SC	82	531 SC	16.5	NA	0.114 J	13.8 J	9, pp. 33-40
		2-4	110	171 SC	82	539 SC	16.8	NA	0.486 J	3.75 J	
		4-6	155	288 SC	76.7 SC	726 SC	19.1	NA	0.391 J	12.8	
		6-8	117	218 SC	63.6	593 SC	14.6	NA	0.562 J	78.1	
		8-10	115	200 SC	51.6 SC	521 SC	13.8	44.9	0.28 J	106 SC	
		10-13	56.8	158	31.7	229 SC/J	10.2	NA	0.729 U	11.6	
		13-16	55.2	112	32.1	193 SC	8.41	NA	0.199 J NCA	2.55 J	
		16-20	90.7	99.2 SC	54.1	258 SC	14	NA	0.269 J NCA	3.75 J	
		20-24	211	1,570 SC	94.8	719 SC	29.9	NA	2.85	289 SC	
		24-28	190	1,230 SC	73.1	389 SC	29.2	NA	1.11 U	23.1	
		28-32	136	731 SC	39.5	292 SC	17.3	NA	0.225 J	182	
		32-36	73.1	435 SC	25.1	222 SC	10.1	NA	1.15 U	15.9	
		36-39	96.9	426 SC	41.1	241 SC	14.2	NA	0.751 U	1.38 J	

Table 4b

1992 USGS Sediment Core Sample Results Showing Background Concentrations (in ppb)

Station	Core No.	Increment (cm)	Total PCBs	DDMU	2,4-DDE	4,4-DDE	2,4-DDD	4,4-DDD	2,4-DDT	4,4-DDT	Ref.
563	128-B1	0-4	50.1	85.8	42.9	410 SC	18.6	NA	0.488 U	51.1	9, pp. 41-48
		4-8	46.5	88.3	50.8	369 SC	21.7	NA	0.454 U	24.6	
		8-12	26.6	0.313 U	26.7	217 SC	NA	NA	0.416 U	1.92 U	
		12-16	29	57.9 SC	28.9	210 SC	NA	NA	0.425 U	1.96 U	
		16-20	47.7	168 SC	30.7	261 SC	15.5	NA	0.498 U	34.5	
		20-24	26.8	80.3	18.6	133 SC	8.13	NA	0.413 U	5.57	
		24-28	54.9	218 SC	35.1	331 SC	NA	NA	0.511 U	26.6	
		28-32	35.2	147 SC	25.7	235 SC	10.3	NA	0.403 U	38.4	

▒ Analyte concentration (or method detection limit if followed by "U") used for comparison to document am observed release to surface water.

NA = Not available.

Data Qualifiers (ref. 9, p. vi):

U Analyte was not detected. Reported value is the method detection limit.

J Confirmed as present, but at a concentration less than the method detection limit.

NCA Analyte could not be confirmed on the second GC column because of analytical interferences.

SC Surrogate was diluted out of range. Result was corrected for the surrogate recovery in the undiluted analysis of the same sample extract. Data validators determined that the data met accuracy and precision requirements.

/J The reported concentration may not be accurate, as judged by associated calibration, reference material, and/or matrix spike results, or precise, as judged by associated replicate results. Overall goals for results at least five times above the method detection limit were approximately ±50% for precision and ±35% for accuracy.

Table 5a describes the samples meeting the requirements of an observed release while Table 5b presents the analytical results for total PCBs and the seven DDT isomers/metabolites for these samples. Table 5b lists the analytical results for surface increments (0-2 or -4 cm) and the increment at depth that demonstrated an observed release of at least one of the hazardous substances for that core sample when compared to the background samples for the same increment. The shaded values on Table 5b meet the following requirements of an observed release (adapted from ref. 1, Table 2-3 for the specific circumstances in this evaluation):

- If the background concentration is not detected (or is less than the detection limit), an observed release was established when the sample measurement equaled or exceeded the background method detection limit.

- If the background concentration equaled or exceeded the method detection limit (and was not J-qualified during data validation), an observed release was established when the sample measurement was three times or more above the highest background. Background concentrations qualified with a J during data validation were not used for sample comparison because background levels were established with data that were not J-qualified.

- If a sample measurement was qualified with a J during data validation, the analysis did not meet all QA/QC requirements and is considered to be an approximate concentration. Because the nature of the sample bias was not provided, it was considered unknown and an adjustment factor was applied to the data before comparing it to the background concentration (ref. 23, pp. 7 and 8). The following adjustment factors were provided by ref. 23: 4,4-DDD, 10.0; 4,4-DDE, 10.0; 4,4-DDT, 12.82. No adjustment factors were provided for DDMU or the 2,4- isomers of DDD, DDE, or DDT; therefore, J qualified data for these substances were not used (ref. 23, p.16). None of the PCB results were J-qualified. If a sample measurement was J-qualified, it was divided by the appropriate adjustment factor and then compared to the background concentration to see if the sample measurement was three times or more above background.

  For example, the 4,4-DDE sample result at the 16-20 cm increment in core sample 160-B1 (Station 514) was 10,800 ppb, qualified with SC/J (see Table 5b). This value was divided by 10.0 to get 1,080 as a sample value. The highest background concentration for this compound at this increment was 337 ppb (see Table 4b). Three times 337 is 1,011. Because 1,080 is greater than 1,011, this sample result meets the observed release criteria in ref. 1, Table 2-3.

Attribution

As effluent emissions of hazardous substances decreased in the early 1970s, the effluent-affected sediments were buried with less contaminated effluent and natural sediment (ref. 5, p. 2; ref. 6, p. 3.3). The highest concentrations of DDE are buried by 30 to 50 cm of sediment (ref. 3, pp. 105, 108, 111, 117). Despite the burial by progressively cleaner particles, the concentration of hazardous substances in the surface sediments is greater than would be expected from the contaminant emission rates through the JWPCP discharge (ref. 5, pp. 2-3). Sediment mixing by biological and physical processes and particulate resuspension from waves, currents, and storms contribute to the continuing release of hazardous substances to surface water and into the food chain (ref. 3, pp. ES-7, ES-8, 29; ref. 5, pp. 2-4; ref. 6, p. 3.3).

Table 5a

July 1992 USGS Sediment Core Samples Documenting an Observed Release to Surface Water from Source 1

Station Number	Core Number	Longitude (decimal degrees W)	Latitude (decimal degrees N)	Water Depth (m)	Length of Core (cm)[1]
514	160-B1	118.4382	33.7585	53	28
518	106-B1	118.4234	33.7343	89	12
519	159-B1	118.4319	33.7333	252	8
524	102-B1	118.4099	33.7211	233	4
532	148-B1	118.3989	33.7225	137	24
533	149-B1	118.3979	33.7205	167	20
534	173-B1	118.3799	33.7300	38	44
536	174-B1	118.3864	33.7233	65	36
539	111-B1	118.3731	33.7243	44	36
542	113-B1	118.3864	33.7135	207	16
544	115-B2	118.3919	33.6983	504	8
550	169-B1	118.3638	33.7150	57	34
552	146-B1	118.3689	33.7070	192	16
553	130-B1	118.3791	33.7008	376	4
555	132-B1	118.3494	33.7125	42	36
556	147-B3	118.3526	33.7083	57	42
557	127-B1	118.3549	33.7041	104	24
559	136-B1	118.3626	33.6980	340	16
564	171-B1	118.3336	33.7000	56	36
566	122-B1	118.3404	33.6933	182	12
570	121-B1	118.3214	33.6871	74	16
571	117-B4	118.3248	33.6840	156	8
572	155-B2	118.3298	33.6760	417	20
574	153-B1	118.3158	33.6898	58	16
577	120-B1	118.3131	33.6830	66	16
581	137-B1	118.3786	33.6938	471	10
583	138-B2	118.3672	33.6725	702	8
584	139-B2	118.3346	33.6626	614	8

[1] Length of core based on the distance between the sediment surface and the lower edge of the increment in which the highest concentration of hazardous substances was identified (listed on Table 2b).

Table 5b

July 1992 USGS Sediment Core Sample Results Documenting an Observed Release to Surface Water (in ppb)

Station	Core No.	Increment (cm)	Total PCBs	DDMU	2,4-DDE	4,4-DDE	2,4-DDD	4,4-DDD	2,4-DDT	4,4-DDT	Ref.
514	160-B1	0-4	356	367 SC	345 SC	3,200 SC/J[1]	52.2	92.4	1.99 NCA	6.88	9, pp. 89-96
		16-20	780	2,280 SC	1,210 SC	10,800 SC/J	NA	174	4.04	15.1	
		20-24	691	2,320 SC	1,190 SC	12,100 SC/J	NA	279 SC/J	4.82 NCA	87.7	
		24-28	427	NA	NA	6,990 SC/J	NA	NA	NA	100	
518	106-B1	0-4	331	198 SC	233 SC	2,060 SC	NA	119 SC	5.23	96.7	9, pp. 1-8
		8-12	851	NA	NA	NA	NA	NA	NA	111	
519	159-B1	0-4	2,790	71.5 SC	228 SC	2,270 SC	NA	NA	7.61 NCA	217 SC	9, pp. 89-96
		4-8	490	NA	322 SC	2,520 SC	NA	NA	NA	NA	
524	102-B1	0-2	433	166	295 SC	3,180 SC	81.8	206	8.06	159/J	9, pp. 1-8
		2-4	624	411 SC	486 SC	4,460 SC	NA	NA	11.4	136/J	
532	148-B1	0-4	6,660	768 SC	596 SC	4,300 SC	177	NA	1.419	447 SC	9, pp. 73-80
		16-20	3,130	7,310 SC	2,580 SC	13,000 SC	500 SC	NA	22.8	242	
		20-24	NA	NA	3,740 SC	18,400 SC	NA	NA	NA	708 SC	
533	149-B1	0-4	930	453 SC	729 SC	5,890 SC	NA	NA	5.95	129	9, pp. 73-80
		16-20	4,310	4,340 SC	3,930 SC	14,300 SC	918 SC	1,750 SC	24	959 SC	
534	173-B1	0-4	246	345 SC	72.8 SC/J	1,070 SC	29.2	NA	1.21 NCA	5.73	9, pp. 105-112
		24-28	492	609 SC	254 SC	2,500 SC/J	NA	128 SC	2.37 J	80.1 SC	
		40-44	818	1,940 SC	311 SC	3,470 SC	100 SC/J	182 SC	3.48	120 SC	

Table 5b

July 1992 USGS Sediment Core Sample Results
Documenting an Observed Release to Surface Water (in ppb)

Station	Core No.	Increment (cm)	Total PCBs	DDMU	2,4-DDE	4,4-DDE	2,4-DDD	4,4-DDD	2,4-DDT	4,4-DDT	Ref.
536	174-B1	0-4	511	641 SC/J	288 SC/J	3,800 SC/J	NA	196 SC/J	4.27 NCA/J	150/J	9, pp. 105-112
		24-28	4,970	11,200 SC/J	7,360 SC/J	41,600 SC/J	1,220 SC/J	NA	32.5 J	2,140 SC/J	
		32-36	5,040	9,020 SC/J	6,330 SC/J	32,600 SC/J	882 SC/J	NA	20.4 J	163 SC/J	
539	111-B1	0-4	419	670 SC	348 SC	2,600 SC/J	78.3	NA	4.63	186 SC/J	9, pp. 9-16
		32-36	553	785 SC	622 SC	3,070 SC/J	NA	NA	3.29	92 SC/J	
542	113-B1	0-4	163	142 SC	132 SC	1,210 SC	NA	130 SC	9.58	224 SC	9, pp. 9-16
		12-16	19	20.9	12 SC	104 SC	NA	NA	0.802 U	14.9	
544	115-B2	0-4	335	124	342 SC	3,140 SC/J	NA	NA	3.82 NCA	40.8	9, pp. 17-24
		4-8	503	222 SC	639 SC	8,150 SC/J	NA	412 SC	22.3	255 SC	
550	169-B1	0-2	987	1,340 SC	1,060 SC	8,310 SC	177	NA	12.6	1,460 SC/J	9, pp. 89-96
		32-34	18,400	NA	NA	NA	2,130 SC	NA	NA	838	
552	146-B1	0-4	623	277 SC	487 SC	5,550 SC/J	108	NA	3.25 J	117 SC	9, pp. 65-72
		12-16	3,730	3,480 SC	3,610 SC	34,000 SC	730	NA	32.5	432	
553	130-B1	0-4	698	169 SC	340 SC	4,150 SC	NA	NA	5.22	43.6 SC/J	9, pp. 41-48
555	132-B1	0-2	278	275 SC	220 SC	3,630 SC	54.1	NA	3.34	143 J	9, pp. 49-56
		34-36	604	NA	NA	NA	NA	NA	2.95	NA	
556	147-B3	0-2	1,550	1,700 SC	1,290 SC	11,350 SC	NA	NA	10.4	895 SC	9, pp. 65-72
		26-28	2,920	NA	NA	NA	326	NA	5.58	333	
		40-42	19,900	NA	NA	NA	2,770	NA	25.2	NA	

Table 5b

July 1992 USGS Sediment Core Sample Results
Documenting an Observed Release to Surface Water (in ppb)

Station	Core No.	Increment (cm)	Total PCBs	DDMU	2,4-DDE	4,4-DDE	2,4-DDD	4,4-DDD	2,4-DDT	4,4-DDT	Ref.
557	127-B1	0-2	1,160	975 SC	1,020 SC	8,690 SC	204	NA	13.4	818 SC	9, pp. 33-40
		22-24	10,500	NA	NA	NA	NA	NA	55.4	NA	
559	136-B1	0-2	348	150	250	1,400 SC/J	NA	NA	12.0 NCA	108	9, pp. 49-56
		14-16	1,730	557 SC	NA	NA	339 SC	NA	NA	NA	
564	171-B1	0-2	1,800	2,020 SC	2,610 SC	20,200 SC	NA	1,340 SC	25.1	496 SC/J	9, pp. 97-104
		34-36	20,300	NA	NA	126,000 SC/J	3,090 SC	NA	172	4,220 SC	
566	122-B1	0-4	474	253 SC	336 SC	4,590 SC	103	491 SC	7.05 NCA	136	9, pp. 25-32
		4-8	1,940	781 SC	1,480 SC	11,300 SC	481 SC	NA	NA	969 SC	
		8-12	221	110	155 SC	1,780 SC	NA	157 SC	14.2	483 SC	
570	121-B1	0-4	422	186 SC	437 SC	2,130 SC	NA	NA	14.6	492 SC	9, pp. 17-24
		12-16	3,680	1,880 SC	3,430 SC	12,200 SC	686 SC	NA	13.6	216 SC	
571	117-B4	0-4	1,160	380 SC	1,270 SC	11,800 SC/J	NA	NA	7.84 J	161 SC	9, pp. 17-24
		4-8	2,890	1,960 SC	3,110 SC	25,900 SC/J	783 SC	NA	19.4	935 SC	
572	155-B2	0-4	910	364 SC	973 SC	11,100 SC/J	NA	NA	795 SC	1,000 SC	9, pp. 81-88
		16-20	945	413 SC	1,100 SC	11,300 SC/J	NA	NA	989 SC	1,000 SC	
574	153-B1	0-4	1,300	508	439	3,280 SC/J	NA	NA	30.3 J	866 SC	9, pp. 73-80
		12-16	5,890	17,700 SC	8,350 SC	33,000 SC/J	2,790 SC	NA	1,420 SC	22,400 SC/J	
577	120-B1	0-4	317	149 SC	241 SC	2,620 SC/J	49.9	142	1.86 J	199 SC	9, pp. 17-24
		8-12	1,470	479 SC	1,080 SC	7,700 SC	113 SC/J	NA	16.9	97.4 J	
		12-16	1,290	490 SC	1,140 SC	7,600 SC	73.5 SC/J	NA	7.65	275 SC/J	

Table 5b

July 1992 USGS Sediment Core Sample Results Documenting an Observed Release to Surface Water (in ppb)

Station	Core No.	Increment (cm)	Total PCBs	DDMU	2,4-DDE	4,4-DDE	2,4-DDD	4,4-DDD	2,4-DDT	4,4-DDT	Ref.
581	137-B1	0-2	483	192	NA	NA	97.5	NA	6.15	75.4	9, pp. 58-65
		6-8	539	185	641	3,100 SC	103	NA	NA	107 J	
		8-10	652	199 SC	557 SC	5,220 SC	NA	NA	25.6	335 SC	
583	138-B2	0-4	339	125	263 SC/J	4,910 SC/J	NA	NA	4.49	75.0	9, pp. 58-65
		4-8	609	142	570 SC	7,320 SC/J	NA	364 SC	7.64	112	
584	139-B2	0-4	296	87.5	221 SC	1,740 SC	NA	151 SC	11.8	109	9, pp. 58-65
		4-8	552	283 SC	574 SC	3,930 SC	204 SC	369 SC	115	265 SC	

Analyte concentration meets the definition of an observed release (Ref 1, Table 2-3). If data is qualified with a /J, an adjustment value was applied s described in Ref. 23. For 4,4-DDD and 4,4-DDE, the sample result was divided by 10 before applying the criteria in Ref. 1, Table 2-3. For 4,4-DDT, an adjustment factor of 12.82 was applied (ref. 23, pp. 7, 8, 16).

NA = Not available.

Data Qualifiers (ref. 9, p. vi):

U — Analyte was not detected. Reported value is the method detection limit.

J — Confirmed as present, but at a concentration less than the method detection limit.

NCA — Analyte could not be confirmed on the second GC column because of analytical interferences.

SC — Surrogate was diluted out of range. Result was corrected for the surrogate recovery in the undiluted analysis of the same sample extract. Data validators determined that the data met accuracy and precision requirements.

/J — The reported concentration may not be accurate, as judged by associated calibration, reference material, and/or matrix spike results, or precise, as judged by associated replicate results. Overall goals for results at least five times above the method detection limit were approximately ±50% for precision and ±35% for accuracy.

4.1.2 Drinking Water Threat

Although an observed release of total PCBs and DDT and its metabolites to the ocean on the Palos Verdes Shelf has been documented (see Section 4.1.1.2), the ocean is not used as a drinking water source nor is it used for irrigation, livestock watering, or as an ingredient in commercial food preparation. The area of contaminated sediments on the Palos Verdes Shelf is far enough offshore that it would not constitute a major or designated recreation area. For these reasons, the Drinking Water Threat was not scored.

Drinking Water Threat Score: 0

4.1.3 Human Food Chain Threat

4.1.3.1 Likelihood of Release

An observed release of total PCBs and DDT and its metabolites to the ocean on the Palos Verdes Shelf has been documented (see Section 4.1.1.2). This water body is part of a fishery (ref. 19, p. 2); therefore the Human Food Chain Threat is evaluated (see Section 4.1.3.3).

Likelihood of Release Factor Category Value: 550

4.1.3.2 Waste Characteristics

4.1.3.2.1 Toxicity/Persistence/Bioaccumulation Factor

Table 6 presents the toxicity, persistence, and bioaccumulation factors for 4,4-DDE, 4,4-DDD, 4,4-DDT, and PCBs. The highest toxicity/persistence/bioaccumulation factor for the Human Food Chain Threat is 5 X 10^8 for PCBs (ref. 2, pp. B-6 and B-16).

Table 6

Waste Characteristics

Hazardous Substance	Toxicity	Persistence	Bioaccumulation	Factor Value	Reference
4,4-DDE	100	1	50,000	5 X 10^6	2, p. B-6
4,4-DDD	100	1	50,000	5 X 10^6	2, p. B-6
4,4-DDT	1,000	1	50,000	5 X 10^7	2, p. B-6
PCBs	10,000	1	50,000	5 X 10^8	2, p. B-16

4.1.3.2.2 Waste Quantity

The Hazardous Waste Quantity assigned from Section 2.4.2 is 3.68 x 10^6. The Hazardous Waste Quantity factor value assigned by ref. 1, Table 2-6 is 1,000,000. Because actual contamination of a fishery is documented (see Section 4.1.3.3.1), the default hazardous waste quantity for the Human Food Chain Threat is 100; the Hazardous Waste Quantity factor value for the site is the greater of these two numbers, or 1,000,000 (ref. 1, Section 2.4.2.2).

4.1.3.2.3 Waste Characteristics Factor Category Value

Multiplying the Toxicity/Persistence factor value of 10,000 by the Hazardous Waste Quantity factor value of 1,000,000 equals 1 X 10^{10}. This value is subject to a maximum of 1 x 10^8 (ref. 1, Section 2.4.3.2). The value 1 x 10^8 multiplied by the Bioaccumulation value of 50,000 equals 5 X 10^{12}, which produces a Waste Characteristics Factor Category value of 1,000 for the Human Food Chain Threat (ref.1, Section 2.4.3.2 and Table 2-7).

Waste Characteristics Factor Category Value: 1,000

4.1.3.3 Human Food Chain Threat Targets

4.1.3.3.1 Food Chain Individual

The ocean waters on top of the effluent-affected sediments are subject to an observed release (see Section 4.1.1.2). Several fisheries of the Southern California Bight incorporate the waters off the Palos Verdes Peninsula, and therefore, the area of the observed release (ref. 22, pp.16, 17, 32; ref. 24, pp. xxii and 23). Fish species known to be caught in the area of the White's Point outfall include sculpin (*Scorpaena guttata*), rockfish species (*Scorpaenidae*), kelp bass (*Paralabrax clathratus*), bonito (*Sarda chiliensis*), mackerel (*Scomber japonicus*), sand dab (*Citharichthys sordidus*), white croaker (*Genyonemus lineatus*), queenfish (*Serphus politus*), surfperch species (*Embiotocidae*), and opaleye (*Girella nigricans*) (ref. 24, pp. xxi, xxii and 23).

Both the commercial and sport white croaker fishery in the vicinity of the White's Point sewage outfalls is closed due to high levels of DDT and PCBs in fish tissue (ref. 17, p.1; ref. 18, pp. 1 and 2; ref. 19, p. 2). The California Environmental Protection Agency's Office of Environmental Health Hazard Assessment (OEHHA) has issued warnings against consuming white croaker off the Palos Verdes Peninsula annually since 1985; the fish has been banned from commercial fishing in this area since 1990 (ref. 17, p. 1; ref. 18, p. 1). Although the white croaker fishery is the only closed fishery, OEHHA has also recommended that consumption of sculpin, rockfishes, and kelp bass caught in the White's Point area be limited to no more than one meal every two weeks for all three species combined (ref. 19, p. 2; ref. 24, p. 149).

Both juvenile and adult white croaker are benthic feeders foraging for polycheates and crustaceans over open sandy bottoms (ref. 20, p. 3-15). White croaker are tolerant of degraded environments and are often found around sewage outfalls (ref. 20, p. 3-15). Studies conducted on white croaker contamination show that DDE levels in the fish decline sharply away from the outfall and that PCB congeners differ in croaker close to the outfall from croaker farther away (ref. 20, p. 3-16). Both data support the assumption that white croaker have only limited movement along the shelf and that they remain in the same area throughout their lives (ref. 20, p. 3-16).

Because the white croaker fishery is closed, and a hazardous substance for which the fishery is closed (PCBs and DDT) has been documented in an observed release to the watershed from the site, level II contamination is assigned to the fishery. A food chain individual value of 45 is assigned (ref. 1, Section 4.1.3.3.1).

4.1.3.3.2 Population

Although Level II contamination is assigned to the white croaker fishery on the Palos Verdes Shelf, no fishery production data are available. Commercial fish catch data identify the poundage of fish landed at a particular port, not where the fish were caught (ref. 21, p. 1). Recreational fishery statistics cover too broad an area (the entire Southern California Bight) to get numbers specific to the Palos Verdes Shelf (ref. 22, pp. 16, 17, 32). Therefore, food chain population was assigned a minimum value of 0.03 assuming that production is greater than 0 pounds per year (ref. 1, Table 4-18).

4.1.3.3.3 Targets Factor Category Value

Summing the Human Food Chain Individual factor value and the Population factor value produces a Targets Factor Category value of 45.03.

Human Food Chain Targets Factor Category Value: 45.03

Human Food Chain Threat Score: 100.00

4.1.4 Environmental Threat

4.1.4.1 Likelihood of Release

An observed release has been documented to the waters of the Palos Verdes Shelf (see Section 4.1.1.3). The Palos Verdes Shelf is part of the habitat for several federally endangered or threatened species including humpback whale (*Megaptera novaeangliae*), brown pelican (*Pelecanus occidentalis*), bald eagle (*Haliaeetus leucocephalus*), peregrine falcon (*Falco peregrinus*) (see Section 4.1.4.3).

Likelihood of Release Factor Category Value: 550

4.1.4.2 Waste Characteristics

4.1.4.2.1 Ecotoxicity/Persistence/Bioaccumulation Factor

Table 7 presents the ecotoxicity, persistence, and environmental bioaccumulation factors for 4,4-DDE, 4,4-DDD, 4,4-DDT, and PCBs. All four compounds produce the highest ecotoxicity/ persistence/bioaccumulation factor for the Environmental Threat at 5 X 10^8.

Table 7

Waste Characteristics

Hazardous Substance	Ecotoxicity	Persistence	Bioaccumulation	Factor Value	Reference
4,4-DDE	10,000	1	50,000	5 X 10^8	2, p. B-6
4,4-DDD	10,000	1	50,000	5 X 10^8	2, p. B-6
4,4-DDT	10,000	1	50,000	5 X 10^8	2, p. B-6
PCBs	10,000	1	50,000	5 X 10^8	2, p. B-16

4.1.4.2.2 Waste Quantity

The Hazardous Waste Quantity assigned from Section 2.4.2 is 3.68 x 10^6. The Hazardous Waste Quantity factor value assigned by ref. 1, Table 2-6 is 1,000,000. Because actual contamination of sensitive environments is documented (see Section 4.1.4.3), the default hazardous waste quantity for the Environmental Chain Threat is 100; the Hazardous Waste Quantity factor value for the site is the greater of these two numbers, or 1,000,000 (ref. 1, Section 2.4.2.2).

4.1.4.2.3 Waste Characteristics Factor Category

Multiplying the Ecotoxicity/Persistence factor value of 10,000 by the Hazardous Waste Quantity Factor Value of 1,000,000 equals 1 X 10^{10}. This value is subject to a maximum of 1 x 10^8 (ref. 1, Section 2.4.3.2). The value 1 x 10^8 multiplied by the Bioaccumulation value of 50,000 equals 5 X 10^{12}, which produces a Waste Characteristics Factor Category value of 1,000 for the Human Food Chain Threat (ref.1, Section 2.4.3.2 and Table 2-7).

Waste Characteristics Factor Category Value: 1,000

4.1.4.3 Environmental Threat Targets

The ocean water above the effluent-affected sediments is part of the habitat for five federally listed endangered or threatened species: humpback whale, brown pelican, bald eagle, and peregrine falcon:

Humpback whale

According to the National Marine Fisheries Service's *Final Recovery Plan for the Humpback Whale* (1991), humpback whales have been seen migrating in the coastal waters of the San Pedro Channel (between Santa Catalina Island and the Palos Verdes Peninsula) (ref. 4; ref. 25, p. 17). It is not clear if the whales use these waters for purposes other than migration, but they have been seen feeding along the migration corridor (ref. 25, pp. 17-18). The humpback whale was listed as a federally endangered species in 1970 (ref. 28, p. 9, 30).

Brown pelican

The brown pelican feeds almost entirely on fish. It catches fish by diving from 6 to 12 meters in the air to either deep or shallow waters (ref. 26, p. 20). It breeds on the Channel Islands and disperses along the entire California coast after breeding (ref. 26, p. 20 and 21). The area off the Palos Verdes Peninsula is considered part of the pelican's summer and winter range (ref. 26, p. 21). The virtually complete reproductive failure of the brown pelican population in the Channel Islands (Anacapa Island) in 1968-1969 led to its listing as federally endangered in 1970 and played a significant role in the banning of DDT from use in the U.S. in 1972 (ref. 14, p. 11; ref. 27, p. 38; ref. 28, pp. 14, 30).

Bald Eagles

The widespread use of DDT, in combination with illegal shooting and habitat loss, led to the bald eagle's decline and designation as an endangered species in 1967 (ref. 29, p. 146; ref. 28, pp. 11, 30). Eggshell thinning is a sensitive indicator of the adverse effect of DDT and its metabolites on avian species (ref. 14, p. 3). DDE is the only chemical known to cause eggshell thinning at environmental levels (ref. 14, p. 3). The levels of DDE in bald eagles on Santa Catalina Island are much too high to allow successful reproduction (ref. 14, p. 12). The average value of DDE residue levels in eggs from Santa Catalina Island is 33.7 ppm which is 10 times higher than the level at which adverse reproductive effects can be expected (ref. 14, p. 5, 12). Reproduction has only been possible using artificial incubation and even then the success rate is very low (ref. 14, p. 5). Biomagnification via gulls and marine mammals is considered to be the major factor in the contamination of bald eagles on Santa Catalina Island (ref. 14, p. 6).

Santa Catalina Island bald eagles are a relatively sedentary population moving only small distances for food (ref. 14, p. 6). They are generalists and opportunistic feeders taking a variety of prey species either live or as carrion (ref. 14, p. 6). Although fish form the bulk of their diet, birds contribute 9 to 19 percent of their diet and marine mammal carrion contributes about 2 percent (ref. 14, p. 6). Bald eagles have been known to feed 16 to 19 km from their nesting areas (ref. 26, p. 122).

Peregrine Falcons

The peregrine falcon disappeared from the Channel Islands in the early 1950s and there are no records of any sightings from 1950 to 1972 (ref. 14, p. 7). They were listed as a federally endangered species in 1970 (ref. 28, pp. 12, 30). Due to a large reintroduction program in the late 1970s and 1980s, some

successful breeding of peregrine falcon now occurs in the Channel Islands (ref. 14, p. 7). Following the ban of the use of DDT, substantial recovery in eggshell thickness has occurred throughout the world; however, the eggshell thickness of peregrines on the central California coast and the Channel Islands has shown no significant improvement in recent years (ref. 14, p. 7). The degree of eggshell thinning now observed in the Channel Islands is likely the highest in the world (ref. 14, p. 8).

Adult peregrine falcons are resident to the Channel Islands, but they feed on a wide variety of avian species (ref. 14, p. 7). They feed almost exclusively on birds; over 50 species of birds have been observed as prey on the Channel Islands (ref. 20, p. 5-23). Although Channel Island peregrines eat some migratory prey, the proportion of migratory prey is lower than that taken by other peregrine populations (ref. 14, p. 7). The home range of the peregrine falcon extends up to 23 km from its nest; size of range fluctuates with prey availability (ref. 26, p. 148).

Although the spacial pattern of DDE contamination in surface sediment samples from Mexico to Northern California show a distinct peak at the Palos Verdes Shelf, there have been few attempts to demonstrate the link between a source of hazardous substances and contamination in sensitive species (ref. 20, p. E-1). Other potential sources of contamination to the coastal biota include migrant birds, migrant fish, runoff from agricultural fields in which Kelthane was used, residual DDT in agricultural fields, global fallout, illegal DDT use, and other coastal sources of PCBs (ref. 20, p. E-4).

A study was conducted as part of the NRDA for the Southern California Bight to determine what concentration of DDE and PCBs needed to be in prey to account for the concentrations found in bald eagles, peregrine falcons and double-crested cormorants inhabiting the Channel Islands, and whether the estimated dietary concentrations indicate that the species must have received much of their contaminant load from prey species in the Palos Verdes area (ref. 20, p. E-7). Model results indicate that levels of DDE and PCBs found in marine birds of the Channel Islands are sufficient to account for the levels observed in peregrine falcons eggs from the Channel Islands (ref. 20, pp. 5-44, 6-3). The modeling also showed that Santa Catalina Island bald eagles receive at least half, and possibly all of their contaminant loads from birds, fish, and mammals caught in the vicinity of the island. Levels of DDE and PCBs in the fish of the Southern California Bight were sufficient to account for contaminant levels in cormorants nesting on Anacapa Island; however, cormorants from Santa Barbara Island (farther north) exhibited lower levels of contaminants suggesting that they may be feeding at least in part from areas that are less contaminated (ref. 20, p. 6-3).

Although it cannot be shown that all of the DDE and PCBs observed in brown pelicans, bald eagles and peregrine falcons comes from local sources (i.e., the Palos Verdes Shelf), it is likely that this is an important source. These species are relatively non-migratory as is much of their prey (ref. 14, p. 12). There is no good evidence that levels of DDT in Latin America are high; DDT has been banned or severely restricted in all Latin American countries along the Pacific Ocean (ref. 14, p. 12). In addition, migratory populations of peregrine falcon have shown marked improvements whereas the reproductive problems and degree of eggshell thinning of the peregrines in the Channel Islands remains high (ref. 14, p. 12). Finally, the DDT to DDE ratio of the contamination found in the avian species is low, indicating that the source of the DDT is old (ref. 14, p. 12).

4.2.4.3.1.2 Level II Concentrations

The area of the Palos Verdes Shelf documented by an observed release of hazardous substances to the ocean is part of the habitat of brown pelican, bald eagles and peregrine falcon living in the Channel Islands because they feed on prey that have accumulated 4,4-DDE and PCBs through the food chain (ref. 14, pp. 11-12; ref. 20, p. 6-3). Humpback whales are known to forage in the channel above the Palos Verdes Shelf (ref. 25, pp. 17-18).

Table 8

Sensitive Environment Targets

Target	Sensitive Environment Classification	Rating Value	Level of Contam-ination	Assigned Factor Value
Brown pelican (*Pelecanus occidentalis californicus*	Habitat known to be used by Federal designated or proposed endangered or threatened species	75	II	75
Bald eagle (*Haliaeetus leucocephalus*)	Habitat known to be used by Federal designated or proposed endangered or threatened species	75	II	75
Peregrine falcon (*Falco peregrinus*)	Habitat known to be used by Federal designated or proposed endangered or threatened species	75	II	75
Humpback whale (*Megaptera novaeangliae*)	Habitat known to be used by Federal designated or proposed endangered or threatened species	75	II	75
Total				300

4.1.4.3.1.3 Potential Contamination

Many sensitive environments exist within the 15-mile target distance limit from Source 1 including, but not limited to: habitat known to be used by the California least tern (*Sterna antillarum browni*), a federally listed endangered species (ref. 26, pp. 278-279); Abalone Cove Ecological Reserve and Point Fermin Wildlife Refuge (ref. 27, p. 201); and Santa Monica Bay National Estuary (ref. 30). Because the dilution weighting factor for coastal tidal waters and shallow ocean zone, where most of the sensitive environments within the 15-mile target distance limit occur, is 0.0001, documenting the presence of these sensitive environments would not contribute significantly to the overall Environmental Threat score (ref. 1, Table 4-13).

Sensitive Environments Target Factor Category Value: 300

Environmental Threat Score: 100.00

5.0 SOIL EXPOSURE PATHWAY

The soil exposure pathway was not quantified because the effluent-affected sediments sit under 30 to 500 m of ocean water (ref. 3, p. 120).

6.0 AIR PATHWAY

The air pathway was not quantified because the effluent-affected sediments sit under 30 to 500 m of ocean water (ref. 3, p. 120).